

Diesel Railway Traction

The Year's Work

IT is almost needless for us to emphasise here the striking developments which have taken place in diesel traction since the publication twelve months ago of our Annual Review number of 1933. The contents of the present Supplement, no less than the matter contained in the other twelve issues of 1934, bear ample witness to the hundred long arms which diesel traction, like a new Briareus, has flung across the world. From the frozen wastes of Canada and Finland to the tropical heat of Siam, India, and the Congo, diesel units are giving economical and reliable service in all railway duties from yard shunting to main-line express working. If any one of the many forward steps made in 1934 can be cited above its fellows, that step is the stated decision of certain Argentine railways that their motive power units of the future shall be driven by oil engines, and that new lines will be laid out for definite operation by diesel vehicles, thus realising to the full the many benefits of that form of traction.

New principles of railway operation in highly-developed countries may eventually follow the outstanding success which has attended the relatively fast, frequent, clean, and economical services provided by hundreds of oil-engined cars in Europe. But whether or not this comes to pass, diesel traction may be credited with the inauguration of a new era in railway speed, for the exploits of the Flying Hamburger and the streamlined trains in the U.S.A. have opened the eyes of both railwaymen and laymen to the commercial speeds which are practicable on main lines. The duties performed by diesel vehicles are infinite in their variety, for although the possible economies can be obtained to the full but rarely, the saving effected in one avenue alone may be sufficient to ensure the adoption of the new form of traction. The application of the diesel locomotive to heavy main-line haulage, hitherto confined to Argentina, Siam, Russia, and Canada, has made a distinct advance by the orders placed on behalf of Indian, American, and French railways for locomotives of 1,300 to 4,000 b.h.p., all of which are to be fitted with electric transmission. But to both railways and manufacturers the possibilities of diesel railcars and shunting locomotives are the most attractive, and every confidence may be felt that the use of such units will increase rapidly throughout the world. Moreover, the increasing demand for speeds of the highest order must inevitably lead to an extension of operation by streamlined diesel trains, and no better advertisement has been given to the capabilities of such units than the general airing of opinions which followed the recent trial run with a steam engine on the L.N.E.R.

Transmission Systems

DIESEL locomotives and railcars might by this time have been expected to possess a great deal in common just as steam locomotives do. Apart, however, from the fact that all have a prime mover of the internal-combustion variety, vast differences are still being perpetuated and even accentuated, more particularly in the transmission system. The past twelve months have seen advances in mechanical and hydraulic systems and yet electric transmission has continued to hold its own

in the high-power field, its match having appeared in the guise only of systems more complicated and costly than itself. During the year the place of the hydraulic coupling in mechanical systems has been more definitely confirmed, it having been specified in almost all contracts for the supply of diesel-mechanical units developing above 100 h.p. By the addition of a baffle the Vulcan-Sinclair traction coupling has been made to give a low drag torque at higher idling speeds, and thus modified it has been found useful where the engine fails to deliver an adequate starting torque until it is accelerated to 500 r.p.m. or more. The ring valve coupling has reappeared in a greatly improved form, and with this it is

possible to cut the idling drag torque down to one sixth of the figure obtainable with the normal traction coupling. In the hydraulic torque converter field there has been yet another development since Leyland Motors Limited adopted and successfully introduced the Lysholm-Smith system for railcars. An hydraulic turbo-converter, so far quite untried in this country, has recently been taken up by the Hydraulic Coupling & Engineering Co. Ltd. This is the Voith converter, which has but one ring of blades on the output rotor and an ordinary fluid coupling to take up the drive when the earlier acceleration period has been completed. For high-power railcars the possibility of dispensing with variable torque-converting arrangements altogether is still receiving consideration. An engine capable of propelling the unit at 80 to 100 m.p.h. will, without the help of any gearing, develop sufficient torque to provide a very fair rate of acceleration even when starting from rest. Such a torque is easily transmitted through a fluid coupling, the only drawback being that if the engine speed must be maintained at a high figure the slip and hence the waste of power will be excessive. Added flexibility in the diesel engine is possible in the future, and the coming of the perfect engine may well bring about the abolition in railcars of variable gears, hydraulic turbines or dynamo-electric couplings. However, no such evasion of the transmission problem can be anticipated in the diesel shunter or train locomotive.

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FIVE OF THE NINE L.M.S.R. DIESEL SHUNTING LOCOMOTIVES IN HUNSLET YARD, LEEDS

THE L.M.S.R. DIESEL SHUNTING LOCOMOTIVES

Various types of engines and transmissions are now being tried by the biggest British railway

WHEN at the beginning of 1933 the L.M.S.R. ordered nine diesel shunting engines from five different makers, there was comparatively little experience available in England as to the behaviour of such machines in heavy yard service, and it was in an endeavour to eliminate this deficiency and give some indication of the best type of unit that the L.M.S.R. order was not confined to the supply of one design only. All the locomotives have now been completed, and although the first of them has been in service for only a few months, exceptionally interesting experiences have been obtained and valuable operating data secured.

Eight of the nine units have mechanical transmission and engines of 150 to 250 b.h.p. Of these, six are fitted with Vulcan-Sinclair hydraulic couplings, two of them in conjunction with epicyclic gearboxes and two with Humphrey-Sandberg free-wheel. Another variation in the transmission systems is that two, three, and four-speed gearboxes are embodied. The first Hunslet locomotive has four steps with a top speed of 30 m.p.h., but all the other geared-drive units are limited to a maximum of 10 or 15 m.p.h. The sole machine with electric transmission, viz., the Armstrong-Whitworth 250 b.h.p. single-motor locomotive, has a maximum designed speed of 25 miles an hour under normal conditions.

The engine types used number eight, of which seven are four-stroke and one, the Harland-Burmeister, two-stroke. The four-stroke units comprise direct injection,

air cell, and pre-combustion chamber types, but the most notable features are the welded construction of the Paxman framing and the sleeve valves of the Brotherhood-Ricardo engine. All the engines are of the medium-speed type and in no case does the rotational speed exceed 1,200 r.p.m. in normal running. The circulating water of all engines is cooled in gilled tube radiators located at the front of the engine bonnet, except in the Harland locomotive, where the oil and water coolers are located

on top of the bonnet in front of the cab. Starting methods vary, but in the mechanical - transmission units there is a preponderance of petrol starting engines with Bendix gears. Fuel is taken on board at convenient times during the day, but in all cases the tanks are of a capacity sufficient to last for two or three days of 24 hr. service; in the Armstrong-Whitworth locomotive enough fuel is carried for a week of such duty.

One of the most interesting points to be settled by these nine locomotives is the best maximum road speed. Practically all yard work can be done on the first gear step, although in practice the drivers are prone to keep in the second step of a three or four-speed unit, even when starting a reasonable load. Nevertheless, there are certain occasions when it would be advantageous to have a somewhat higher top speed than can be obtained with but two gear steps, although the latter arrangement permits of the maximum of simplicity. Three gear steps with a top



One of the L.M.S.R. 150 b.h.p. diesel shunters

CHARACTERISTICS OF L.M.S.R. DIESEL SHUNTING LOCOMOTIVES

L.M.S.R. No.	Wheel Arrangement	Loco. Builder	Engine Make	Engine		Transmission	Clutch	Max. Speed, M.P.H.	Max. Tractive Effort, Lb.	Weight in W.O. Tons
				B.H.P.*	R.P.M.					
7050	0-4-0	Drewry Car Co. ...	Allen ...	160	1,200	Mech. 4 speed†	Vulcan-Sinclair Friction	12	11,200	26
7051	0-6-0	Hunslet Engine Co.	M.A.N. ...	150	—	Mech. 4-speed	Friction	30	—	21
7052	0-6-0	do.	McLaren ...	150	1,000	Mech. 2-speed	Friction	9	12,000	26
7053	0-6-0	do.	Brotherhood-Ricardo	150	1,200	Mech. 2-speed	Vulcan-Sinclair	9	12,000	26
7054	0-6-0	do.	Paxman ...	180	900	Mech. 3-speed	Vulcan-Sinclair	13	14,400	29
7055	0-6-0	Hudswell Clarke ...	Mirlees-Ricardo ...	150	1,000	Mech. 3-speed	Vulcan-Sinclair	13	?	30
7056	0-6-0	do.	do. ...	150	1,000	Mech. 3-speed	Vulcan-Sinclair	13	?	30
7057	0-6-0	Harland & Wolff ...	Harland-Burmeister	170	1,100	Mech. 3-speed	Vulcan-Sinclair	13	11,200	27.5
7058	0-6-0	Armstrong-Whitworth	Armstrong-Sulzer ...	250	775	Electric	—	25	24,000	40

* Continuous.

† Epicyclic gearbox.

‡ Humphrey-Sandberg freewheel on main shaft.

§ Humphrey-Sandberg gearbox clutches.

speed of 14 or 15 m.p.h. make a very flexible operating unit without the handicap of low starting tractive effort. In most of the duties assigned to these L.M.S.R. locomotives periods occur when very high tractive efforts have to be developed, e.g., the haulage of 650 to 700-ton goods trains for half-a-mile or so, with a start over curves and crossings, but this duty has been performed satisfactorily by a four-speed locomotive weighing only 21 tons.

The final drive of the whole batch of nine shunters is through coupling rods, and, in six units, through a jack-shaft also. This makes a neat and simple arrangement, especially in the case of electric transmission where only one motor is required. With the exception of the loco-

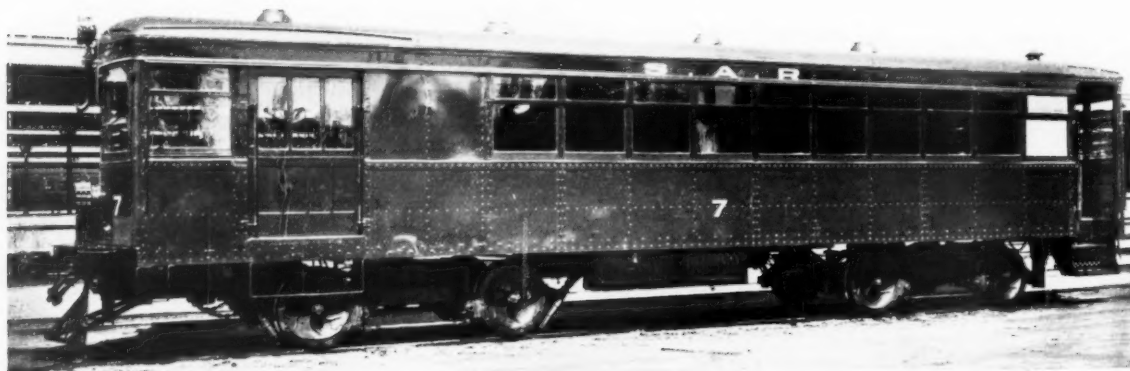
motive ordered from the Drewry Car Co. Ltd., all are of the six-wheeled type; the wheelbase of the Hunslet locomotives does not exceed 9 ft. 0 in., but the Harland unit has a wheelbase of 12 ft. 0 in., and the Armstrong-Whitworth diesel-electric locomotive is spread over a base of 13 ft. 0 in. The maximum axle load in the Armstrong and Drewry units is 13.5 tons, but the geared-drive six-wheelers do not exceed 10.5 tons. The L.M.S.R. has within the last week ordered ten diesel-electric shunting locomotives of 300 b.h.p. from Armstrong-Whitworth at a cost reported to be £10,000 each. These locomotives will weigh approximately 50 tons, and will be powered by Armstrong-Sulzer diesel engines.

THE FIRST DIESEL RAILCAR IN AUSTRALIA

The South Australian Railways has recently rebuilt a broad-gauge petrol vehicle as a diesel unit

AFTER carefully watching developments in all parts of the world, Australian railways are now taking a practical hand in diesel traction, and to the South Australian Government Railways belongs the credit of introducing the first oil-engined railcar in the continent. The car is running on the 5 ft. 3 in. gauge lines round Adelaide, and is a rebuild of a model 55 railcar which previously was powered by a petrol engine having four cylinders of 4½ in. bore and 6 in. stroke and a piston-swept volume of 425.3 cu. in. The new diesel unit is of the

level. Although the consumption of lubricating oil during this test period (covering several thousand miles) proved alike for both cars, the fuel consumption figures were remarkable. Whereas the petrol engine ran only 3.7 m.p.g., its diesel counterpart covered almost exactly three times that distance to the gallon, the actual figure being 9.6 m.p.g. As the relative costs of petrol and Diesel fuel oil are 1s. 3½d. and 6½d. per gal., it will be seen that big economies should result from the adoption of more diesel units in similar service. The diesel car,



Gardner-engined diesel-mechanical railcar, South Australian Government Railways

5LW Gardner type, and has five cylinders with a bore of 4½ in. and a stroke of 6 in., the rated b.h.p. being 85 at 1,700 r.p.m., as compared with the 68 at 1,600 of the former unit. The compression ratio is 13 to 1, and the airless injection is on the direct system through spray nozzles with four small apertures; turbulence is ensured by means of a masked inlet valve. The injection nozzle stands vertically in the top of the combustion chamber and the piston crown is flat.

In order to make really comparative tests of the new and old engines, two cars, identical in weight and dimensions, were put into similar service at the same time. Both cars were fitted with standard gearboxes. The diesel engine showed an increase in power of 15 per cent. on a 1 in 45 gradient and maintained a greater speed on

which was rebuilt at the railway's Islington workshops, is shown in the accompanying illustration.

Starting of both diesel and petrol engines is effected by a 12-volt electric motor, but generally speaking the diesel unit starts more readily from cold than the other, nor does it need to be warmed up before going into service. The diesel engine can idle at about 200 r.p.m., a feat which is beyond the petrol unit, but the latter operates a little more quietly up to speeds of 1,000 r.p.m. When 1,600 r.p.m. is reached, however, there is little to choose between the two. As yet no trouble has been experienced with the diesel engine, and inspection of the spray nozzles proved that they were not in need of cleaning. Satisfactory results over a period will doubtless lead to the introduction of further cars.

LATEST DEVELOPMENTS OF THE GANZ CAR IN HUNGARY

Three entirely new designs have been introduced during the last nine months

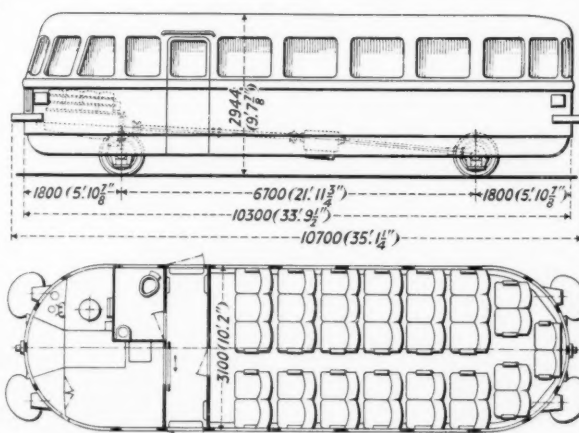
WHEN dealing in our issue of November 2 with the progress made in recent years with the adoption of diesel railcars in Hungary we gave illustrations and particulars of the types which have been introduced during the last six or seven months, and by the co-operation of Ganz & Co., which firm has supplied approximately 100 diesel cars to the Hungarian State Railways, we now present further illustrations and particulars of these vehicles.

Three entirely new designs have been introduced during the course of 1934, viz., a single-engine double-bogie semi-streamlined railcar of 275 b.h.p. for speeds up to 75 m.p.h.; a double-engine double-bogie car of 550 b.h.p. intended for the haulage of trains with a maximum speed of 56 m.p.h. on both main and branch lines; and a four-wheeled semi-streamlined 36-seater railbus of 95 b.h.p. All three types have Ganz-Jendrassik pre-combustion chamber engines and all are fitted with mechanical transmission, the larger units having a five-speed gearbox which, together with the engine, is mounted directly on the bogies.

The express cars are now operating a service over the main line from Budapest to the Austrian frontier at Hegyeshalom, and a through journey to Vienna has been made, with a top speed *en route* of 81 m.p.h. The interior of the third-class compartment of one of these cars is shown in the illustration at the bottom of this column. Trains of ten or eleven trailers can be hauled on normal schedules by the 550 b.h.p. railcars, and a speed of 60 km.p.h. (37.3 m.p.h.) can be maintained on the level when hauling the maximum number. Cars of this type are shown in two of the accompanying illustrations. As shown by the diagram on this page, the 95 b.h.p. railbus has the engine located in the driving compartment at the forward end.



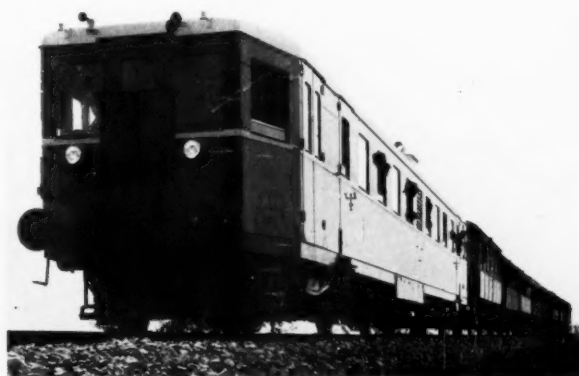
One of the latest Hungarian diesel-mechanical railcars



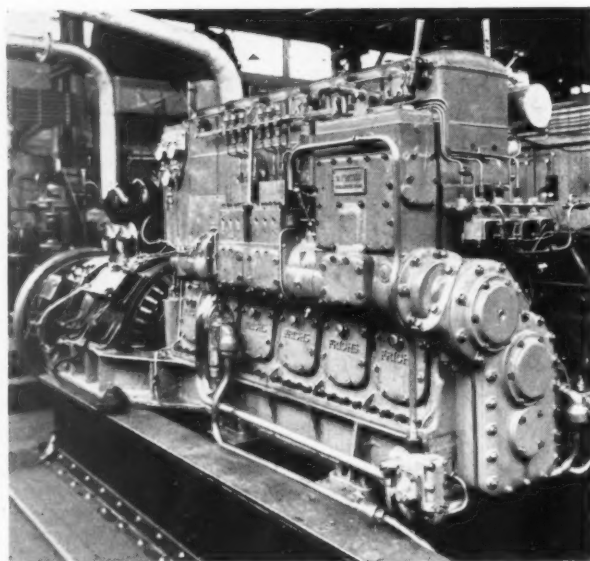
Above: Arrangement of 95 b.h.p. diesel-mechanical railbus with single-end drive and semi-streamlined contour. Hungarian State Railways



Interior of new 275 b.h.p. express railcar



Double-engine 550 b.h.p. Ganz railcar



Frichs six-cylinder 195 b.h.p. diesel engine as used for locomotive service in Denmark

PRIOR to 1934, the most powerful diesel engine used in railway work was the Krupp supercharged six-cylinder four-stroke engine developing 1,350 b.h.p. at 450 r.p.m., which was closely followed by the Beardmore 12-cylinder V engine with an output of 1,330 b.h.p. at 900 r.p.m. The former was originally intended for installation in a 1,450 b.h.p. locomotive for the Boston & Maine Railroad but was eventually transferred to the Reichsbahn, and the rating reduced by 7 per cent. At the beginning of this year, the Busch-Sulzer Bros. Corporation, in the U.S.A., brought out an eight-cylinder two-stroke V engine developing 1,600 b.h.p. at 550 r.p.m., and although this particular engine has not yet been mounted in a locomotive, the maker has received an order for a 10-cylinder unit of the same design which will develop 2,000 b.h.p. An output of 200 b.h.p. per cylinder is not unknown in traction work, for the 1,200 b.h.p. M.A.N. engines used in Russia have only six cylinders and are of the four-stroke type, whereas the Busch-Sulzer unit operates on the two-stroke principle and has 9.2 explosions per sec. per cylinder in place of 3.35 in the M.A.N. engine. The Busch-Sulzer machine was illustrated and described in the issues of this Supplement for January 26 and March 23.

Lighter and Faster-Running Engines

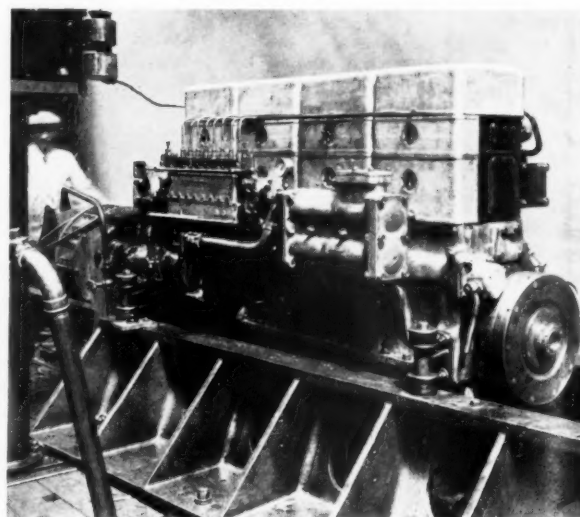
A more unobtrusive but just as far reaching advance has been the wider recognition given to the desirability of light compact engines running at high rotational speed. Builders such as Frichs and Sulzer, who have for years built engines of 28 to 36 lb. per b.h.p. turning at a maximum of 775-800 r.p.m., have developed new ranges weighing half to two-thirds of the above figure and running at 1,000 to 1,500 r.p.m. without sacrificing the high standard of reliability for which their older models are noted. An investigation of a dozen engines of 80 to 225 b.h.p. introduced during the last two years shows that the average weight per b.h.p. on the continuous rating is 18 lb., and the corresponding figure for a similar number of engines of 250 to 420 b.h.p. is 18.5 lb. An average from 12 types of engine in service in 1931 is

PROGRESS IN ENGINE DESIGN

Notable advances have been made during the year in the design and application of heavy-oil engines to railway traction

33 lb. per b.h.p. This improvement has been obtained mainly by pushing up the speed and pressures by a closer approach to the constant-volume cycle, but the use of cast steel and aluminium alloys has contributed its quota. Modern engines vary from the 11 lb. per b.h.p. and 1,400 r.p.m. of the Maybach 410 b.h.p. engine to the 27 lb. and 900 r.p.m. of the C.S.D. 380 b.h.p. engine and the 25 lb. and 550 r.p.m. of the 1,600 b.h.p. Busch-Sulzer unit. There can be no doubt that reliable high-speed engines raise the general standard of railcar design and performance, for they not only permit of lighter transmission equipment but their smaller bulk reduces the amount of floor space not available for revenue purposes. For a given output the whole vehicle is lighter and enables a higher maximum speed or higher rate of acceleration to be attained.

Another feature of the year has been the advance made by the two-stroke engine, although this has been confined mainly to the U.S.A. where the Winton units set to work are used invariably in conjunction with electric transmission. The 600 b.h.p. Winton engine is now installed in the Burlington Zephyr and the 12-cylinder 900 b.h.p. model in the Union Pacific six-car train, both of which are described in another part of this issue. In Europe, the Burmeister & Wain engine, with approximately 30 applications, leads the field in the larger sizes (up to 350 b.h.p.) but the use of the opposed-piston Junkers type in powers of 85 to 110 b.h.p. is increasing at a rapid rate in France. The two-stroke engine is somewhat more inflexible than the four-stroke, but this makes no difference when electric transmission is incorporated. In certain French cars, however, the two-stroke engines drive the wheels through a five-speed gearbox, whereas equivalent

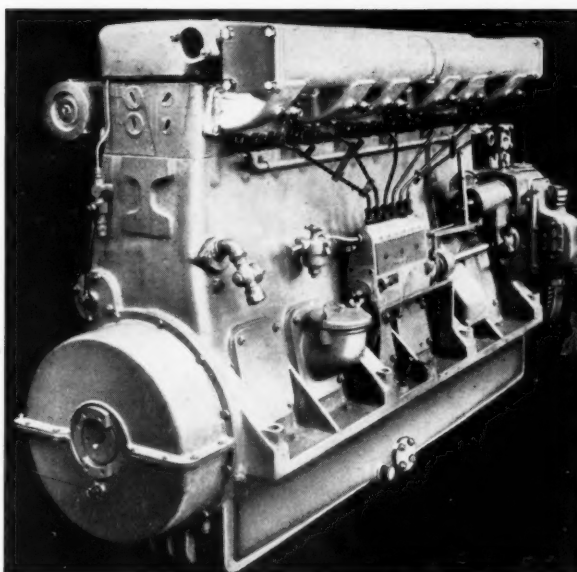


Eight-cylinder 365/410 b.h.p. Ganz engine as fitted to the new double-bogie railcars in Spain

four-stroke cars have only four gear steps. The scavenging problem at speeds of over 1,100 r.p.m. or so has not yet been solved, and railcar engines of the two-stroke type usually work at 600-800 r.p.m. It is difficult to see how really big engines can be constructed for railway work unless the two-stroke principle is adopted, and this has been recognised in America, where the powers required for main line work are anything from 2,500 h.p. upwards. In the lowest power range a number of diesel locomotors of 25-60 b.h.p. are fitted with two-stroke engines.

The desirability of encroaching to the least extent upon the floor space has led to the adoption of horizontal engines in certain cases. This method was adopted first at the beginning of 1932 when the Swiss Locomotive Works delivered to the Swiss Federal Railways a 300 b.h.p. vehicle with the engine and gearbox beneath the centre of the floor, and recently the Czechoslovak State Railways has acquired a number of light four-wheeled cars with eight-cylinder horizontally-opposed Skoda engines of 120 and 160 b.h.p. running at 1,600 r.p.m. In these examples the transmission is electric, but thanks largely to the high engine speed it has been found possible to make the directly-coupled generator small enough to lie entirely below the car floor. Although the simplicity resulting from a small number of moving parts is generally thought to be desirable, there has been a tendency to use multi-cylinder V engines for small powers. For instance, the Simmering eight-cylinder V engine is rated at 160 b.h.p., the Renault twelve-cylinder engine at 250 r.p.m., and several makes are in service with twelve cylinders developing a total of 300 to 450 b.h.p.

At the beginning of the year the L.M.S.R. set to work a shunting locomotive powered by a 150 b.h.p. Brotherhood-Ricardo engine with sleeve-valves, and the advantages of this type in quieter running and reduced maintenance costs may lead to further applications, especially where space is restricted in the vertical direction. Another locomotive of the L.M.S.R. series is powered by a Paxman engine with a welded steel framing, and a good deal more is likely to be heard of this method of construction in the future, for it permits of a weight reduction of about 50 per cent. compared with a cast iron frame of equivalent strength. The Paxman framing embraces the crankcase, cylinder block, and sump, but various other



M.A.N. six-cylinder 165 b.h.p. high-speed light weight diesel engine as used in German and other railcars

makers have adopted welded steel bedplates in lieu of cast steel.

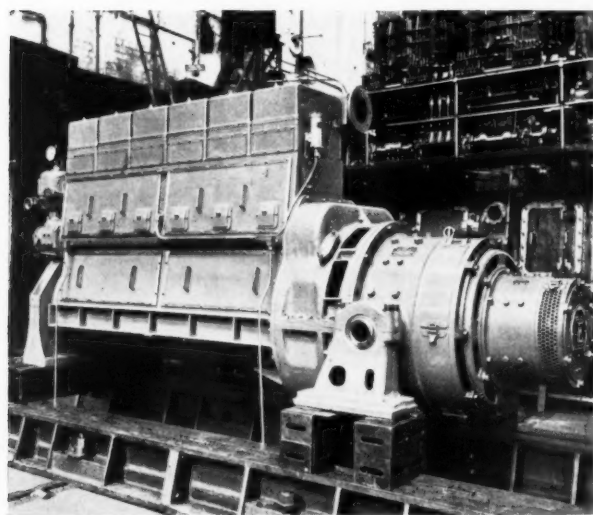
The large variety of starting methods which has always been a feature of railway diesel engines still persists, but among geared shunting locomotives, at least, an auxiliary petrol barring engine seems to be attaining more popularity. However, the large number of small high-speed engines similar to road transport units, now being used with mechanical transmission, has brought a great extension of the use of electric starting motors fixed to the crankcase. De-compression cams are often fitted to assist in starting the engine from dead cold, but in the Ganz type of engine the air inlet valves are kept closed until the suction stroke is almost completed. This operation is required only until the combustion chamber is heated up, the normal valve timing being switched in after half-a-minute or so. The system is based on the fact that gases of a certain pressure flowing into a vessel in which a lower pressure exists, undergo an increase in temperature.

The following table gives the leading characteristics of engines which have been applied to railway traction service for the first time during the past year.

RAIL TRACTION DIESEL ENGINES INTRODUCED IN 1934

Engine	Continuous B.h.p.	No. of Cyls.	R.p.m.	Cyl. Bore and Stroke, In.	Wt. per B.h.p. Lb.
Krupp	65	4	1,000	5.31 × 7.87	26.0
Skoda	120	8*	1,600	4.33 × 5.9	?
Leyland	130	6	2,000	4.625 × 6.0	—
Berliet	135	6	1,700	4.92 × 6.69	16.5
Armstrong-Saurer ..	140	6	1,500	5.12 × 7.1	18.3
Brotherhood-Ricardo	150	6	1,200	5.3 × 8.5	?
Allen	160	6	1,200	5.73 × 7.1	35.7
Paxman	200	6	900	6.5 × 10.0	?
Beardmore	225	6	1,200	6.5 × 9.0	23.5
Frichs	240	6	1,000	6.89 × 10.23	15.8
Ganz	275	6	1,450	6.71 × 8.7	17.6
English Electric ..	300	6	675	10.0 × 12.0	—
Mercedes Benz ..	300	12†	1,500	5.43 × 6.69	13.3
Ganz and Stork-Ganz	400	8	1,450	6.71 × 8.7	16.0
M.A.N.	420	12‡	1,400	6.89 × 7.1	16.5
Frichs	450	6	650	10.23 × 13.0	31.8
Frichs	550	6	650	11.22 × 13.0	31.4
Winton	660	8†	750	8.0 × 10.0	20.8
Winton	900	12‡	700	8.0 × 10.0	21.0
Busch-Sulzer ..	2,000	10‡	550	13.5 × 16.0	24.5

* Horizontal engine. † Two stroke. ‡ V-type.



Six-cylinder 300 b.h.p. English Electric engine as developed for locomotive purposes



225 b.h.p. Beardmore-engined diesel-mechanical shunting locomotive built by Hawthorn-Leslie for the Air Ministry

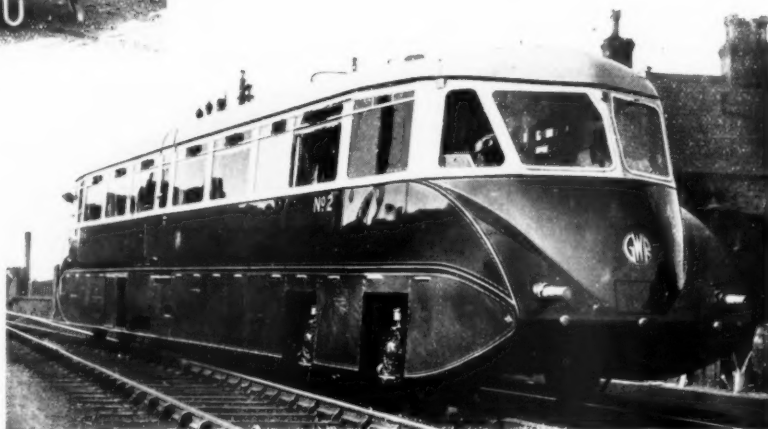
IF British diesel traction activities during the year have not been of great magnitude compared with what has been done on the Continent and in North America, they are, at least, encouraging when the problems peculiar to this country are considered, and there is every hope of a steady (though, perhaps, slow) advance in the adoption of oil-engined units. The export trade, although not of great monetary value, has been such as to fatter the anticipation that a good deal of work will come to these shores in future years, for the field covered has been wide in the geographical and technical senses, and already there are signs that British designs will be paramount in such countries as India and Argentina.

The most noteworthy application in England during 1934 was the inauguration on July 9 by the Great Western Railway of a supplementary express service between Birmingham and Cardiff maintained by three double-engine A.E.C. diesel-mechanical railcars of 260 b.h.p. The end-to-end speed is 49.50 m.p.h., including a 2 min. stop at Gloucester and momentary halts at Newport and Cheltenham, a schedule which is well within the capacity of the cars without the necessity of exceeding a speed of 70 m.p.h. Two services a day are run in each direction and the fuel tank capacity is sufficient to enable a mileage of 475 to 500 being covered without refuelling. The design and construction of these vehicles was described in great detail in the issues of June 15 and July 13, but one or two slight modifications have been made within the last four months. The cars as a whole are noteworthy in that the order was placed in February, yet the cars had to be ready for the beginning of the summer timetables on July 9, although the design was new in many respects.

Another railcar application of the year was the three 130 b.h.p. four-wheeled cars delivered by Leyland Motors Limited to the L.M.S.R. in February and March. These vehicles are fitted with the Leyland (Lysholm-Smith)

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hydraulic transmission, which incorporates direct geared drive at road speeds above approximately two-thirds of the maximum. Two of the cars are proportioned for a top speed of 56 m.p.h. and the third for 63 m.p.h. In addition to the transmission system these units are further noteworthy for their light weight, a tare of 10.5 tons carrying 40 seated passengers. This gives the high ratio of 11.3 b.h.p. per ton of tare, and has enabled accelerations up to 2.2 m.p.h. per sec. to be registered at low speeds and 1.0 m.p.h. per sec. from rest up to 50 m.p.h. On a trial run from Preston to Carlisle in March last, one of these cars ascended the four miles at 1 in 75 up



The first of the G.W.R. 260 b.h.p. express diesel-mechanical cars built by the A.E.C. for service between Birmingham and Cardiff

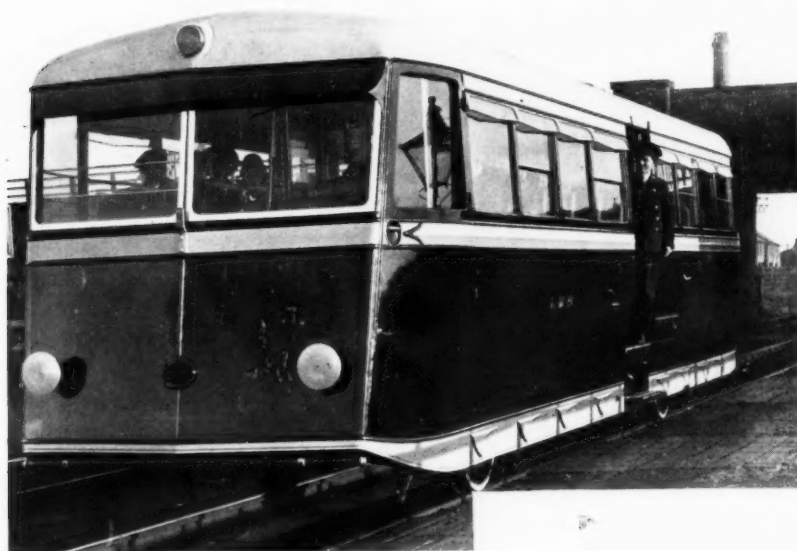
the south side of Shap at a sustained speed of 54.56 m.p.h. despite a heavy wind and snowstorm, and the fuel consumption for the 90 miles from Preston to Carlisle averaged 13.5 m.p.g. An accompanying illustration shows one of these Leyland cars in normal work between Blackpool and Lytham.

On the L.N.E.R., the success of the *Tyneside Venturer*, the 250 b.h.p. Armstrong-Whitworth diesel-electric railcar, led to the purchase of two further vehicles of the same type, named *Northumbrian* and *Lady Hamilton*. These new vehicles are operating fast supplementary services in the Leeds, Hull, York and Harrogate districts, at schedules varying from 47 to 52 m.p.h., in which service we have timed them at 58 m.p.h. over a length of 14 miles without speed rising above 64 m.p.h. at any point. The *Tyneside Venturer* itself has been working on the Yorkshire coast line between Scarborough and Whitby, and during the summer made a daily scenic excursion from Scarborough to Malton, Goathland and Whitby, and thence back to Scarborough along the coast line; in September it was assisted in this service by the Armstrong-Saurer engined 95 b.h.p. diesel-electric railbus, which was purchased by the L.N.E.R. in June and overhauled at the maker's works before going into regular operation.

Apart from the L.M.S.R. diesel shunters (described elsewhere in this Supplement), one of the most interesting locomotive applications during the year was the diesel-

IN GREAT BRITAIN

mechanical unit built by Hawthorn-Leslie for the Air Ministry, which is depicted in the first of the illustrations accompanying this article. Powered by one of the new standard 225 b.h.p. Beardmore engines running at 1,200 r.p.m., the locomotive is of the six-wheeled type with a three-speed gearbox, from which the torque is transmitted to the wheels via a jackshaft and coupling rods. The engine is located in a bonnet in front of the cab and is started by compressed air; cooling of the circulating water is effected in a Serck radiator at the front of the locomotive. From the engine the drive is taken through a Vulcan-Sinclair traction-type hydraulic coupling, which is fitted with an air-operated internal-expanding rocking brake to stall the coupling runner when the engine is idling. The gearbox clutches are of the Humphrey-Sandberg freewheel type, and with normal engine revolutions the road speeds are 4.7, 8.4, and 15.0 m.p.h. The reversing gear is of the spiral bevel type and is housed in a separate part of the gearbox; Ransome & Marles roller bearings are used throughout the transmission system. The frames and running gear follow Hawthorn-Leslie's standard practice. The wheels are 3 ft. 4 in. diameter, and to enable the locomotive to negotiate sharp curves the wheelbase has been limited to 8 ft. 4 in.; the weight in working order is 27 tons, the fuel capacity 100 gal.



Above: A Leyland 130 b.h.p. diesel-mechanical railcar engaged in passenger service in the Blackpool district, L.M.S.R.

Right: The two latest 250 b.h.p. Armstrong-Whitworth diesel-electric railcars purchased during the year by the L.N.E.R., and now engaged in the Yorkshire area

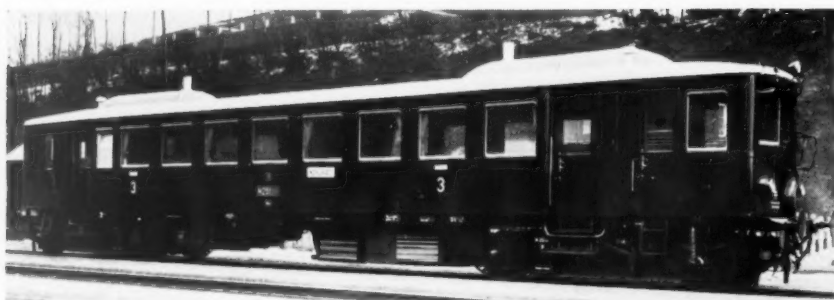
and the lubricating oil capacity 30 gal. The locomotive is used for shunting duties and for the haulage of store trains over a six-mile length of line connecting an aircraft depot with the L.N.E.R.

Further locomotive activities of 1934 were the completion of the English-Electric 300 b.h.p. diesel-electric shunting locomotive now in trial service on the L.M.S.R. (of which the mechanical portion was built by Hawthorn-Leslie); the delivery of another 74 b.h.p. diesel-g geared locomotive to the Eagle Oil Co. Ltd. by the Drewry Car Co. Ltd.; the inauguration of a diesel service on the North Sunderland Railway with a 95 b.h.p. Armstrong-Saurer engined unit (see *Diesel Railway Traction Supplement*, August 10); and the supply of a similar unit to the last-named to the Dunston power station of the North Eastern Electric Supply Company. For export, Armstrong-Whitworth has turned out a varied selection of locomotives, trains, and railcars, including the 450 b.h.p. articulated train for the Buenos Ayres Western Railway, which is described elsewhere in this issue; a 140 b.h.p. railcar for the same railway; a 140 b.h.p. railcar for the Kalka-Simla Railway, a similar unit for the Central Provinces section of the Great Indian Peninsula Railway, and six 160 b.h.p. power units and chassis for the Madras & Southern Mahratta Railway. Two 880 b.h.p. locomotives with Armstrong-Sulzer engines have also been shipped from Scotswood to Ceylon for trial on mail trains. Other diesel locomotives exported from this country during the year are illustrated on another page.

Steady progress has been made in the application of diesel railcars to branch line and suburban work in Northern Ireland and the Irish Free State. The Co.

Donegal Railways, under the direction of Mr. Henry Forbes, has added to its stock of diesel cars another 74 b.h.p. Gardner-engined unit, and the Great Northern Railway of Ireland has recently acquired a larger car but with the same type of engine for service over the Bundoran branch. The largest diesel car in Ireland is the twin-engined 260 b.h.p. unit on the Northern Counties Committee (L.M.S.R.), which is operating services out of Belfast to Kilroot. All these vehicles have been described in this Supplement during the past six months. The Co. Donegal Railway is to put another car into service in 1935, and the Northern Counties Committee a diesel locomotive.





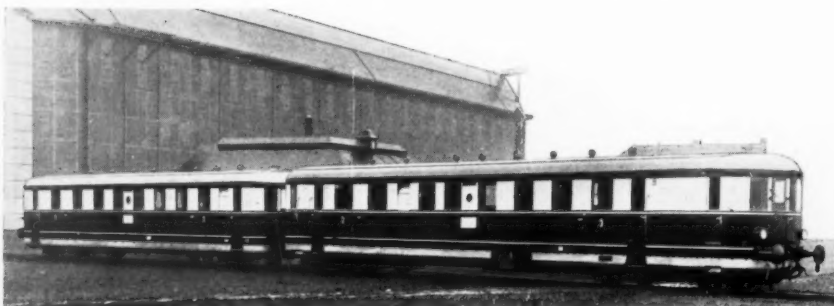
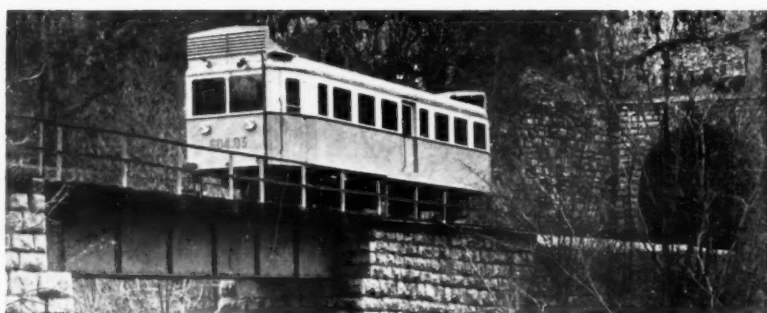
Standard-gauge 320 b.h.p. double-bogie diesel-electric railcar running on roller bearings, Czechoslovak State Railways

One of the numerous 135/150 b.h.p. Ganz diesel-mechanical railcars which are in branch and local service on the Hungarian State Railways



Four of the 820 b.h.p. diesel-electric triple-car trains of the Netherlands Railways at Utrecht

One of the five 120/150 b.h.p. four-wheeled diesel-mechanical railcars built by Ganz for slow passenger service on the Belgian National Railways



A large number of double-bogie diesel-electric railcars with semi-permanent driving trailers have been built for the German State Railway. The unit shown is powered by a 410 b.h.p. Maybach engine

DIESEL TRACTION ADVANCE IN EUROPE

DESPITE the welter of super-speed streamlined trains ordered and set to work in the U.S.A. during 1934, there can be no gainsaying the fact that diesel traction has reached its highest development in Europe, for during the past twelve months great strides have been made in all phases except, perhaps, main line locomotives.

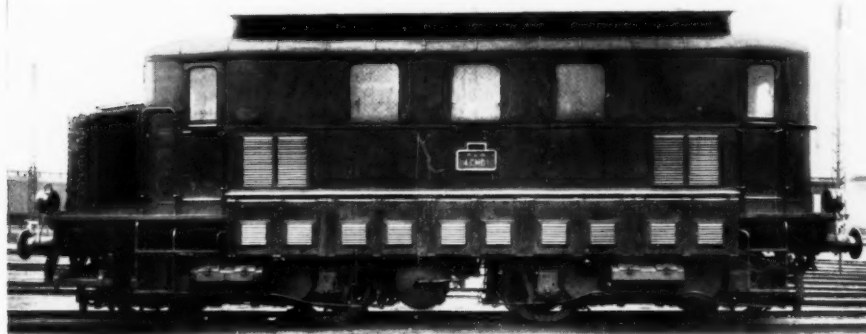
In the shunting world, Deutz has been finishing off an order for 200 diesel-mechanical tractors of 65 b.h.p. for the Reichsbahn, and Frichs have built several units of 65 to 125 b.h.p. for the Danish State Railways. Heavier machines, of 72/85 b.h.p. with electric transmission, have been set to work on the Netherlands Railways, the engines being of the Stork-Ganz type. An order for another 21 tractors of the same type was passed in the autumn. Light shunting locomotives, some with electric and some with mechanical transmission, have been set to work in France, and the P.L.M. introduced another heavy diesel-electric shunting locomotive, making five in all upon that system. This unit, which is illustrated at the foot of this page, is powered by a 600 b.h.p. two-stroke Burmeister & Wain engine, and forms the largest application of the two-stroke principle in Europe, apart from the direct-drive Deutz machine which is still in the experimental stage. The P.L.M. locomotive scales 70.5 tons, and, like the four previous shunters, is required to work for 22 hr. a day.

Light passenger locomotives have not made the headway which was predicted a few years ago, largely owing to the favour which has been shown to the railcar as an operating unit. Nevertheless, the type of traffic existing on many private lines in Denmark can be worked profitably by such machines, and Frichs has turned out several units of almost standard types varying in output from 215 to 415 b.h.p. The Deutsche Werke A.G., of Kiel, has constructed for light mixed trains some 150-175 b.h.p. diesel-gear units of the type described in this Supplement for June 15 last, and the Austrian Federal Railways has

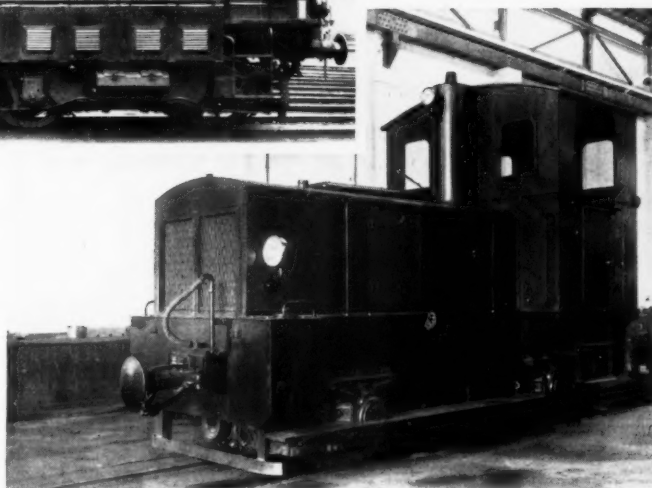
gained increased experience with 300 b.h.p. four-wheeled diesel-electric locomotives which are used for passenger and goods trains with a top speed of 28 m.p.h. In the realm of high power, only in the U.S.S.R. can definite progress be recorded. One or two 2,400 b.h.p. diesel-electric goods locomotives and a number of 1,200 b.h.p. machines have been built at the Kolomna works, and trials are being conducted with an express locomotive of 2,400 b.h.p. An order for an engine of 1,400 b.h.p. is understood to have been placed with the M.A.N. for incorporation in a locomotive with Voith hydraulic drive, which is to be acquired by the German State Railway.

Something like 600 diesel railcars and trains are now in service on the Continent. The year 1934 saw the introduction of diesel traction in Poland, Lithuania, Estonia, Norway, and Luxembourg, and, apart from railwayless Albania, the only European countries which have no diesel units at work or under construction are Bulgaria, Latvia, Portugal, and Turkey. One of the greatest developments came at the end of the year, when the Belgian Vicinaux Railways placed an order for no fewer than 100 Gardner-type oil engines for installation in old steam and petrol railcars. Spanish railways have also gone ahead in the introduction of light and heavy diesel cars, and units from 90 to 400 b.h.p. are now at work. During the year, the Belgian National Railways acquired a Maybach-engined 410 b.h.p. articulated car and five 120/150 b.h.p. Ganz cars, the latter being similar to the design which has found such great favour in Hungary, where practically 100 cars built by Ganz are in service, and vary from 550 b.h.p. double-engine units for heavy train work to 275 b.h.p. streamlined cars and 95 b.h.p. railbuses.

The German State Railway put into service numerous four-wheeled and double-bogie cars of 120 to 410 b.h.p. The Czechoslovak State Railways, now in the midst of a large diesel programme, introduced the Blue Arrow diesel-electric express service between Prague and Bratislava and the diesel train development in Holland and Denmark is well known. The large amount of work done in France is recorded in another article in this issue.

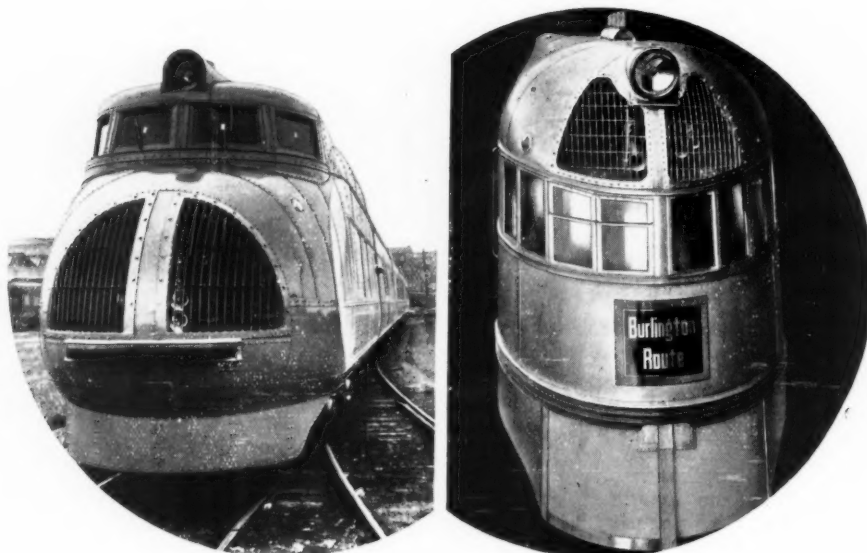


Above: Heavy 600 b.h.p. diesel-electric shunting locomotive with Burmeister & Wain two-stroke engine on the P.L.M. Railway



Right: One of the numerous 125 b.h.p. standard-gauge diesel-mechanical loco-tractors built by Frichs for the Danish State Railways

NORTH AMERICAN HIGH-SPEED TRAINS OF 1934



IN the history of American railways, 1934 will be recorded as marking the renaissance of rail-roading, the year when the roads ceased "beefing" about the in-roads of competitive transportation and set about to meet and best such opposition through the medium of a superior service to the public.

First of the 1934 crop of American high-speed trains was the M-10000 of the Union Pacific line, finished and delivered to her owners in January. Built by the Pullman Car and Manufacturing Company, the M-10000 is an articulated, three-car, 72-ton train built of an aluminium alloy and powered by a 600 b.h.p. V-type 12-cylinder distillate-burning Winton engine operating through electric

A new era in long-distance super-speed transport has been inaugurated by orders for ten streamlined trains, three of which are already in service

By RODGER L. SIMONS

recovery of a satisfactory volume of passenger traffic.

The M-10000 has a sister craft in the recently-completed M-10001, a six-car, articulated train patterned closely after the former, but made up of a power car, mail and baggage car, three sleepers and a coach-buffet car, representing a total capa-

city of 124 passengers. Powered by a 900 b.h.p. 12-cylinder submarine-type Winton diesel engine driving a General Electric generator, the M-10001 is 376 ft. long, and weighs but 188 tons as against 625 tons for an equivalent steam train.

It was this train which left Los Angeles at 10 p.m. October 22 and drew in at Grand Central Terminal, New York, at 9.55 a.m. October 25, averaging a trifle under 60 m.p.h. for the entire trip. In making the coast to coast run in 56 hr. 55 min., the M-10001 cut by 14 hr. 28 min. the record established in 1906 by a special train of the late Edward H. Harriman, the founder of to-day's Union Pacific system. During the high point in the recent spurt, the M-10001 is reputed to have covered two miles in one minute, or 120 m.p.h., but 112.5 m.p.h. appears to be the highest authenticated rate.

In the few months since its dedication on April 18, the Burlington Zephyr has almost achieved the status of an American institution—so much so, in fact, that a motion picture, "The Silver Streak," has been produced in Hollywood with this train as the central character. Plyng a densely-populated and heavy traffic area in the rich Mississippi valley, the Chicago, Burlington & Quincy Railroad makes a strong bid for its slice of this business with the inauguration of service on the Zephyr, and sister trains soon to be initiated.

Unpainted, relying on its stainless steel sheathing for protection from the elements, the Zephyr is a rivetless, all-electric-welded train of 87½ tons, hardly more than the weight of a standard American sleeping coach. Her three articulated cars are driven at speeds of 80 to 100



The 660 b.h.p. stainless-steel Burlington Zephyr

transmission. Completed at a cost of more than £40,000, the M-10000 represents the first step by the Union Pacific, one of America's leading transcontinentals, toward the

m.p.h. by a 660 b.h.p. straight-eight Winton two-stroke diesel engine, operating through General Electric generator and motors on the forward bogie.

Of special interest is the framework of the train, embodying the lattice method of construction, with plates and parts secured by the newly introduced system of shot-welding. A series of regularly timed shots of electric current results in absolute uniformity of the welded joint, with a row of stitches, as it were. It is a process developed over several months' time by the Edward G. Budd Manufacturing Company, builders of the Zephyr, and has been applied not only to the Zephyr but to a petrol-driven train on the Texas & Pacific R.R., to diesel railcars on the Pennsylvania and Reading Railroads, and to an electric suburban train in New York.

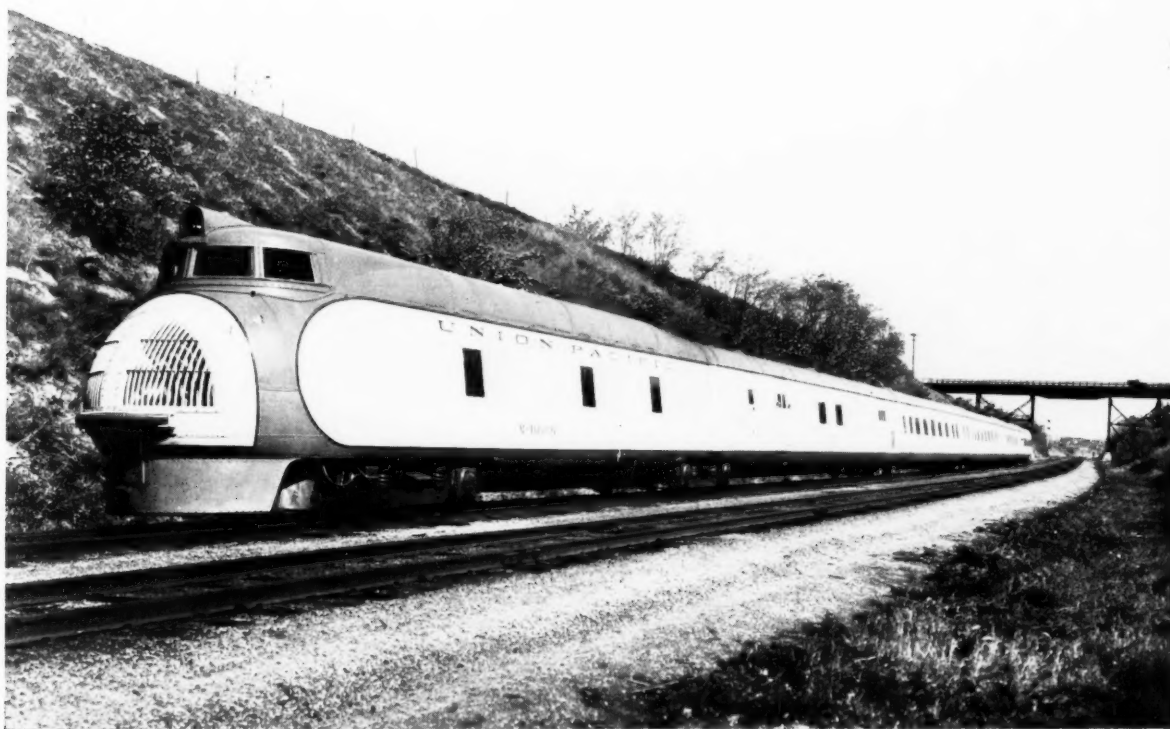
After a summer of tests and display appearances, such as at the Century of Progress Exposition in Chicago, the Zephyr went into regular service on November 11 between Lincoln, Nebr. and Kansas City, Mo., a 251-mile run involving considerable mail, freight and passenger traffic. The Zephyr makes one complete round trip daily in 4 hr. 52 min. running time each way, equivalent to 52 m.p.h., but this speed is to be increased as time goes on. Regular service has not yet been initiated with the Union Pacific M-10000 series of three, six, and nine-car trains.



Interior of the solarium lounge of the Burlington Zephyr

templated run between Boston and Providence, she is expected to do 44 miles in 44 min., including an intermediate stop at Back Bay station, on the outskirts of Boston.

The Gulf, Mobile & Northern Railroad has also placed an order with the American Car & Foundry Company for two 600 b.h.p. diesel-electric triple-car trains, having buffet, sleeping, and observation accommodation, and the Boston & Maine Railroad has contracted with General Motors Corporation and E. G. Budd Manufacturing Company for the delivery of a 660 b.h.p. triple-car unit. Finally, the Illinois Central Railroad has ordered at a cost of £80,000, a five-car articulated diesel-electric train from the Pullman Car & Manufacturing Corporation. This unit is to be powered by a 1,200 b.h.p. Winton two-stroke



The six-car articulated 900 b.h.p. diesel-electric train on the Union Pacific system



The Burlington Zephyr at high speed. From a photograph taken on the occasion of the record trip from Denver to Chicago on May 26, when it covered the 1,015 miles non-stop in 785 min., equivalent to 77.6 m.p.h.

engine and will be put into express service between Chicago and St. Louis. By the end of 1935, at least ten super-speed diesel trains should be in operation in the U.S.A., and should do much to recapture trans-continental and inter-city traffic lost to air and road interests.

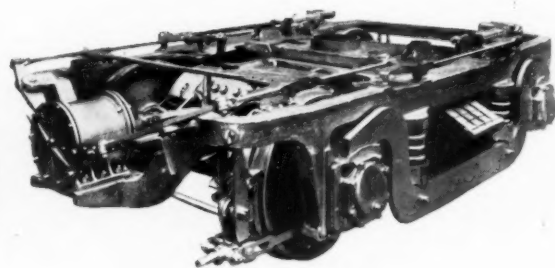
Since going into revenue service the Zephyr has raised the passenger revenue from 50 cents per train-mile with steam to \$1, and the total revenue to \$1.65 per train-mile. During the first week of operation the average number of passengers carried between all points was 91, compared with 67 on the steam train. A questionnaire given to the passengers showed that 67 per cent. would have used the service in any case, 10 per cent. would have used some other steam service, 5 per cent. would have gone by private motor car or by air, and 18 per cent. were attracted by the novelty. Increases in the number of passengers between different points varied from 83 to 160 per cent. During the first week of its operation, the Zephyr was run into by a lorry at a level crossing when running at 35 m.p.h., but suffered only slight damage.



Shot-welded steel frame of the Burlington Zephyr



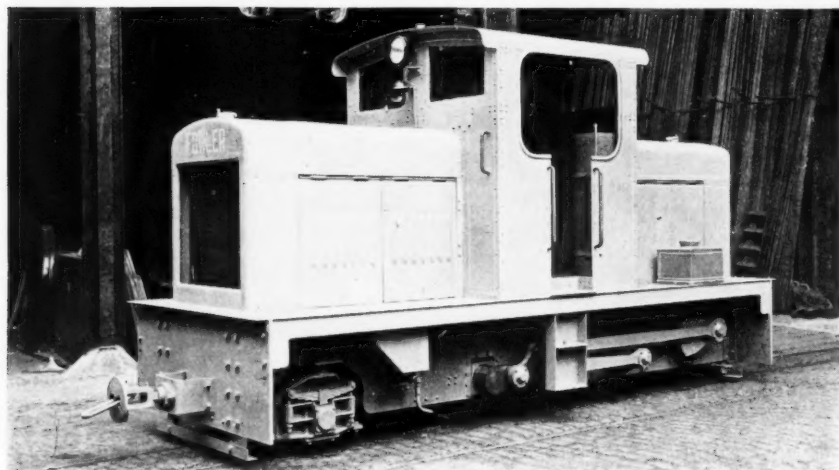
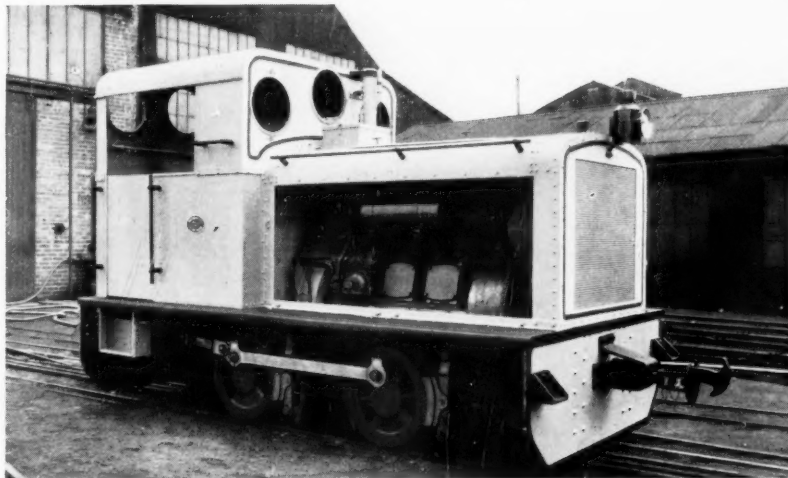
Winton 660 b.h.p. two-stroke engine



Driving bogie of the Burlington Zephyr

SOME 1934 BRITISH DIESEL VEHICLE EXPORTS

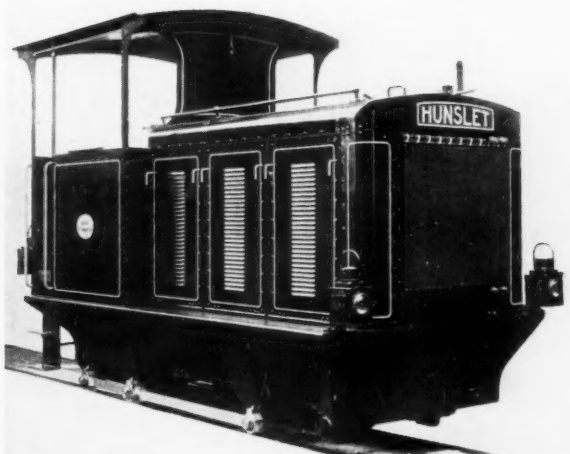
A 55 b.h.p. diesel-geared locomotive built by W. G. Bagnall Ltd., for the metre-gauge lines of the Assam Railways and Trading Co. Ltd. The engine is of the two-stroke Bagnall-Deutz type. The locomotive has a maximum speed of 12.5 m.p.h. and can start and haul a load of 260 tons



Diesel-mechanical locomotive of 85 b.h.p. built by John Fowler & Co. (Leeds) Ltd. for operation on a narrow-gauge line in Natal having curves of 80 ft. radius. The locomotive weighs 17 tons and is fitted with the Westinghouse air brake

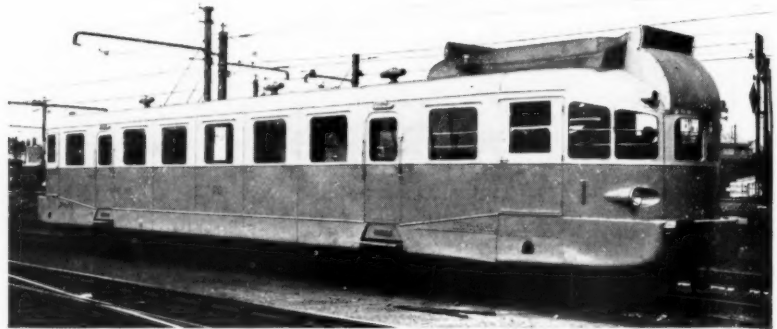
Right : A Hunslet diesel locomotive for service on the Egyptian Delta Light Railways. It is fitted with a 120 b.h.p. McLaren engine

Below : 95 b.h.p. diesel-electric railcar supplied by Armstrong-Whitworth to the Kalka-Simla Railway, India



FRENCH DIESEL RAILCAR PRACTICE

Almost 200 oil-engined railcars are now at work on various classes of passenger traffic, and a further 109 vehicles are on order for delivery in 1935



A standard 250 b.h.p. Renault railcar on the P.O. Railway

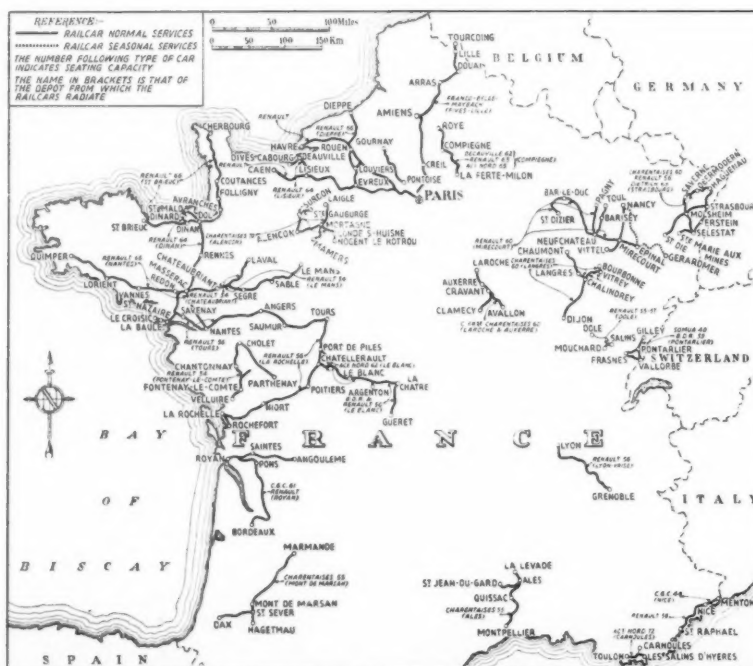
ALTHOUGH the extension of diesel railcar operation in France during the second half of 1933 and the first half of 1934 was almost phenomenal, there appears to be no sign of slackening off. Already, the seven great French railways have in operation 176 diesel cars and another 109 on order, and it will be surprising if further orders are not forthcoming within the next few months, for there is a good deal of evidence to show the ability of the diesel car in recapturing traffic lost to the road and in developing business where little or none existed previously. A number of cars are also in operation on the lines of secondary companies and bring the total of diesel railcars at work or under construction to about 300. Through the courtesy and co-operation of the general

managers and chief mechanical engineers of the various French railways we are able to give a complete list of the diesel cars at work and on order for the seven big systems. The accompanying table is a summary of the present position:—

Railway	Cars in Service	Cars on Order
Etat..	77	6
P.O.-Midi	19	30
P.L.M.	38	46
Nord..	12	10
Est ..	8	14
Alsace-Lorraine	22	3
	176	109

The 289 diesel cars included in the above table have come from the works of 14 different contractors and embody nine different designs of engine in 16 different powers, which were built (some under foreign licence) by 11 different companies. The powers vary from 65 to 820 b.h.p., but with the exception of the triple-car Maybach-engined trains on the Nord and a 140 b.h.p. four-wheeled car on the P.L.M., mechanical transmission is universal, although some cars have electric remote control or electro-magnetic gearbox clutches. The top speeds vary normally from 56 m.p.h. to the French legal maximum of 75 m.p.h., but certain vehicles are permitted to run above the latter figure. The double-unit Renault car on the Etat, for instance, has a maximum speed of 87 m.p.h., and the Nord 820 b.h.p. trains have attained 98 m.p.h.

Some makers have definitely standardised railcars of certain types and powers, and these have been widely adopted by the French railways. Consequently, identical vehicles may



Map showing lines on which diesel railcar services are in operation on the seven big French railway systems

be found in all parts of the country, and with the growth of diesel traction and the closer co-operation of the railways in matters affecting operation, this policy should eventually prove of great value. Even now the railways are reaping the benefit of a lower initial cost resulting from one set of drawings, patterns, and dies. The principal standard cars are the 250 b.h.p. 56-seater Renault; the double-engine 210 b.h.p. De Dietrich; and the 80 b.h.p. eight-wheeled Charentaises, but two or three other makes are to be found on more than one line. Whenever possible, a star system of working has been adopted, a number of cars being shedded at one depot and working therefrom in all directions, as may be seen from the accompanying maps.

At the moment of writing, the Etat is much the largest user of diesel railcars, but if the total number of vehicles at work and on order is considered, the P.L.M. number exceeds that of the Etat. The Etat cars are to be found all over the system, working local, semi-fast, and express trains, and six of the smaller Renault cars are engaged in newspaper traffic. How rapidly railcar services are being developed on the Etat may be gauged from the fact that the daily mileage on May 1 last was 9,000 km. (5,600 miles); on July 1 it was 13,000 km. (8,100 miles); and on October 1 had risen to 17,000 km. (10,600 miles). These figures include the mileage of petrol as well as diesel cars; on October 1 there were 44 petrol cars (10 of an old type) and 71 diesel cars in service, so, allowing equal mileage per vehicle, the diesels aggregated about 11,000 km. (6,850 miles) a day. On the P.L.M. the



Map showing the operation of the various types of railcars on the French State Railways

36 cars then in service were covering an aggregate monthly mileage of 150,000 km. (94,000 miles), to which figure they had risen in 15 months from about 6,000 km. (3,700 miles) as shown by the graph on this page. The mileage should rise considerably during 1935 with the addition of new cars.

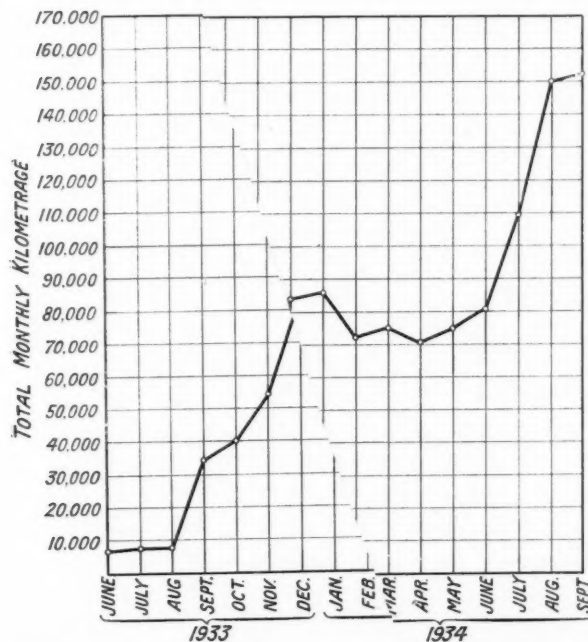
The table below gives brief particulars of the diesel cars now operating on the big French lines.

PARTICULARS OF FRENCH DIESEL RAILCARS

(Mechanical Transmission unless otherwise stated)

Railway	No. of Cars	Date Placed in Service	Car Builder	Engine B.h.p.	Tare Weight, Tonnes	Max. Speed, M.p.h.	No. of Seats
Etat	10	1931	Renault	85	11.2	56	34
"	14	1933-34	"	250	23.0	75	56
"	28	1934	"	250	25.0	75	50
"	6	1934	"	100	9.5	56	35
"	1	1934	"	500	67.0	87	90
"	4	1933	Charentaises	80	9.5	56	55
"	2	1934	Somua	210	28.5	56	75
"	2	1934	Ac. du Nord	280	30.0	75	74
"	4	1934	Cie. Gen. de Con.	105	17.0	56	44
"	6	1934	De Dietrich	210	23.0	75	51
P.L.M.	2	1933	Somua	80	11.7	56	40
"	2	1933	Renault	250	25.0	75	56
"	2	1933	Ac. du Nord	170	33.6	75	72
"	4	1933	Cie. Gen. de Con.	140	17.7	56	44
"	4	1933	Charentaises	80	11.3	56	55
"	2†	1934	Cie. Francaise	140	17.5	56	40
"	4	1934	B.D.R.	105	12.5	56	39
"	2	1934	Charentaises	80	11.7	56	60
"	2	1934	Delaunay	65	11.8	56	40
"	14	1934	Renault	250	29.0	75	56
P.O.-Midi	9	1932-33	Charentaises	80	9.0	56	55
"	2	1933	Renault	250	23.0	75	66
"	2	1934	Ac. du Nord	170	32.0	75	85
"	2	1934	B.D.R.	110	13.0	56	26
"	4	1934	Charentaises	110	12.0	56	42
Nord	2	1934	Decauville	260	26.0	75	64
"	2	1934	Ac. du Nord	250	30.0	75	66
"	2	1934	Renault	250	25.0	75	58
"	2*	1934	Franco-Belge	820	118.0	100	144
"	2	1934	Cie. Francaise	260	26.0	75	64
"	2	1934	B.D.R.	270	26.0	75	65
Est	6	1933	Renault	250	27.0	75	56
"	2	1934	Charentaises	120	15.0	56	61
A.-L.	1	1933	"	80	9.5	56	69
"	11	1933-34	De Dietrich	210	23.0	75	58
"	1	1933	Renault	250	21.0	75	56
"	9	1934	"	250	29.0	75	66

* Electric transmission. † One with electric transmission.



Graph showing growth of P.L.M. diesel railcar mileage

DIESEL TRACTION ACTIVITIES IN SOUTH AMERICA

A great future for oil-engined vehicles of various types is predicted in Argentina

SINCE the beginning of diesel traction in post-war years Argentina has shown itself to be a fruitful field for manufacturers. Under the direction of Mr. P. C. Saccaggio, the Buenos Ayres Great Southern Railway in 1929 commenced a comprehensive programme of experiments covering suburban, and light and heavy main line work, and as a result of the experience gained, four 1,700 b.h.p. units were delivered in 1933. Within the last twelve months the diesel fever has spread to other railways, and if the future is judged by the remarks of Sir Follet Holt to the shareholders of the Buenos Ayres Great Southern and Buenos Ayres Western Railways, Argentina will soon lead the world in the number of main-line diesel locomotives and trains. At the annual meeting of the B.A.G.S. Railway Sir Follet said that the results of the existing vehicles had been so valuable that it would no doubt pay the company to replace over a period of years

way Carriage & Wagon Co. Ltd., and will be delivered in the spring of 1935. The dimensions of this car will be found on the diagram on the next page.

After a number of preliminary demonstrations, the first of which was attended by the President of the Argentine Republic and the Minister of Public Works, the car was put into special service between the company's Buenos Aires terminus (Plaza 11 de Setiembre) and Lujan during the recent International Eucharistic Congress (October 10-14), for the convenience of pilgrims wishing to visit the celebrated shrine at Lujan. The service consisted of three non-stop journeys in both directions daily between the points mentioned. The daily mileage worked out at 335, and the average train speed was 40 m.p.h. The service proved popular, as was shown by the fact that over 600 passengers were carried in the 50-seater unit. On November 1 a new main-line service with this diesel unit

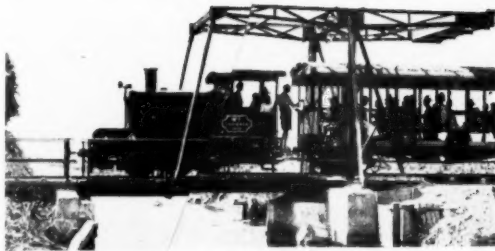
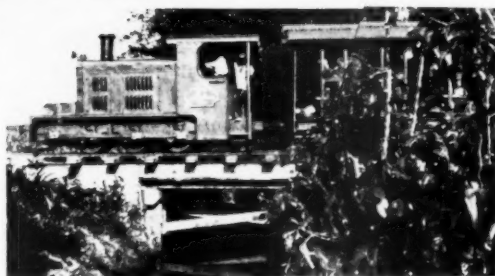


Above: 450 b.h.p. Armstrong-Whitworth diesel-electric train, Buenos Ayres Western Railway

all its steam locomotives with diesel engines, and it was unlikely that the Great Southern would again ship a steam locomotive to Argentina. Further, the directors were considering the construction of a 50-mile branch from Ajo to Dolores, and, when built, this line would probably be the first in the world to be laid out definitely for diesel traction, and would have no running sheds or watering stations. To the shareholders of the Buenos Ayres Western Railway, Sir Follet Holt said that the directors were looking to diesel traction to bring about a substantial reduction in operating costs.

Actual deliveries during the year have been confined to the Buenos Ayres Western Railway, where a 450 b.h.p. articulated diesel train (see illustration on this page) and a 140 b.h.p. diesel railcar (see next page) have been placed in service. Both units were constructed by Armstrong-Whitworth; the train is powered by a 450 b.h.p. Armstrong-Sulzer engine and the railcar by a 140 b.h.p. Armstrong-Saurer light-weight high-speed engine, and both types incorporate electric transmission. Another railcar, with a 140 b.h.p. Gardner oil engine and mechanical transmission, is now being built by the Birmingham Rail-

Below: Two Fowler six-coupled diesel-mechanical locomotives at work on a sugar plantation estate in British Guiana



was put into operation between Bragado and Buenos Aires. The train runs every week day in both directions (starting from Bragado) on a 3½-hr. schedule for 131 miles, in-

cluding seven intermediate stops. This timetable allows a traveller with a special day return ticket about 6½ hr. in the capital. A buffet for providing light meals has been installed, and as the price of the special return tickets is extremely moderate, the new service should prove very popular. The smaller Armstrong-Whitworth car is just completing its trials.

The 450 b.h.p. train consists of an engine and equipment vehicle articulated to the passenger carrying portion, and is arranged to run in both directions. Vestibule connections and standard couplings are fitted at each end so that the unit may be coupled to existing corridor or non-corridor stock. Side entrance doors are provided on each side of the coach near the centre. The body structure is of metal throughout, but a small amount of wood is used for the interior finish. Insulation against heat and sound is fitted in the roof, sides, and floor. The accommodation is for first class passengers only, but lower class accommodation is provided by trailers. The overall length of the vehicle is 89 ft. 10 in., of which the passenger car accounts for 57 ft. 6 in.; the seating capacity is 50 on a tare weight of 67 tons and a maximum axle load of 16 tons. A top speed of 72 m.p.h. can be attained, and the designed starting tractive effort is 14,000 lb. The transmission includes a direct-coupled main generator and two axle-hung traction motors. The control is fitted with a dead-man handle attachment and is arranged for multiple-unit operation, and the vehicle is heated throughout by electricity. Performance requirements include the ability to operate satisfactorily at heights up to 1,570 ft. above the sea.

Accommodation for 57 passengers is provided in the 140 b.h.p. Armstrong-Whitworth double-bogie diesel-electric railcar; this vehicle, and also the 450 b.h.p. train just described, is intended principally to replace more expensive steam trains in the outer suburban districts. The two 140 b.h.p. Gardner-engined streamlined diesel-mechanical cars now being built are to have a cruising speed of 60 m.p.h. They will be air-conditioned, and will have 20 reversible arm-chair seats.

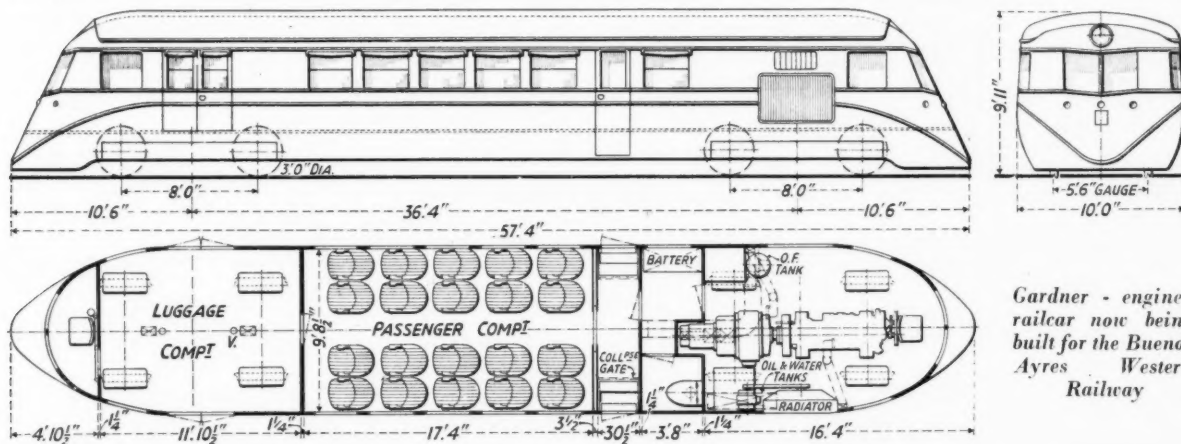
Big developments in other Argentine railways have just been announced or are pending. The 4-ft. 8½-in. gauge Entre Rios Railway has just ordered 11 double-engine cars of approximately 260 b.h.p. from the Birmingham Railway Carriage & Wagon Co. Ltd., and these vehicles will



140 b.h.p. Armstrong-Whitworth railcar on the Buenos Ayres Western Railway

be fitted with Gardner engines, Vulcan-Sinclair hydraulic couplings and Wilson preselective epicyclic gearboxes. They will have all-metal streamlined bodies 68 ft. 6 in. long, with a seating capacity of 54 in two classes, with lavatory and luggage compartments. The Central Argentine and Buenos Ayres Pacific Railways are also interested in diesel traction, and it is reported that the Argentine State Railways has just ordered 25 diesel-mechanical railcars from Ganz, of Budapest.

In Brazil, the 450 b.h.p. Armstrong-Whitworth diesel-electric *de luxe* express on the San Paulo Railway has attracted a good deal of attention since it went into regular service between San Paulo and Santos in June last. This train was illustrated and described in the issues of this Supplement for December 1, 1933, and August 10, 1934. Within recent months, light diesel-mechanical locomotives have been supplied to sugar plantations in British Guiana.



Gardner - engined railcar now being built for the Buenos Ayres Western Railway

A NEW AUTOMATIC COUPLER FOR DIESEL STOCK

German design fitted to diesel and electric cars

THERE has long been a desire for a coupling which, when automatically coupling two vehicles mechanically, would connect also any air pipe and electrical connections. The necessity for such a fitting has become much more urgent since the diesel railcar development became rapid, and there is now on the market a fully-automatic device made by the Scharfenberg Kupplung A.G., of Berlin, which has been applied successfully to the diesel trains of the Netherlands Railways, and to electric and diesel vehicles in Germany, Austria, and Argentina. The application to the Dutch units was illustrated and described in the issues of this Supplement for March 23 and May 18 last.

A feature of the Scharfenberg (Schaku) device is that coupling and uncoupling are automatic, and the simplicity of the fitting compared with a standard screw and link coupling is evident from an examination of the two illustrations at the bottom of this page. When two cars meet, the projecting arm of one coupler runs up that of the other and presses back the cover of the coupling proper, and at one and the same moment enables the coupling of the drawbars, air-brake conduit, heating pipes, and electrical connections to be effected. The coupled units are then ready to start.

Uncoupling is carried out by means of compressed air. A foot pedal in the driver's compartment is depressed, and allows air to pass from the reservoir to the release cylinder contained in the coupler head; the action of this cylinder puts out the mechanical coupler and simultaneously closes the air brake and heater pipes and disconnects the electric jumpers. As uncoupling can be

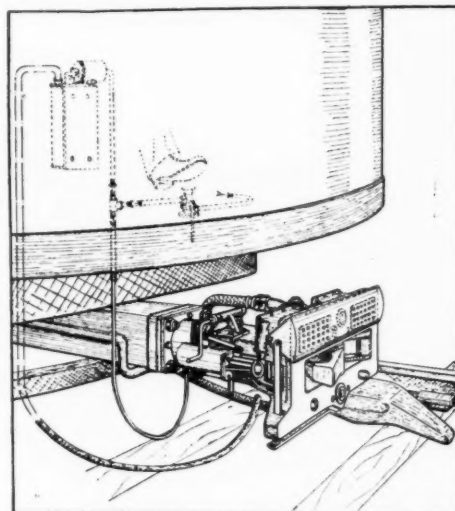
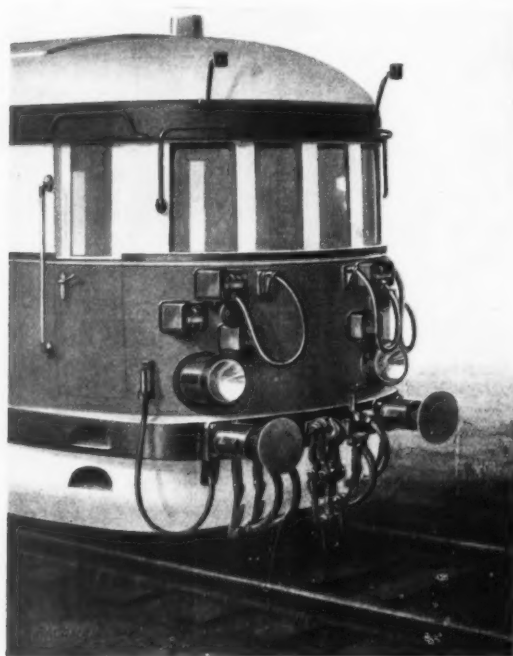
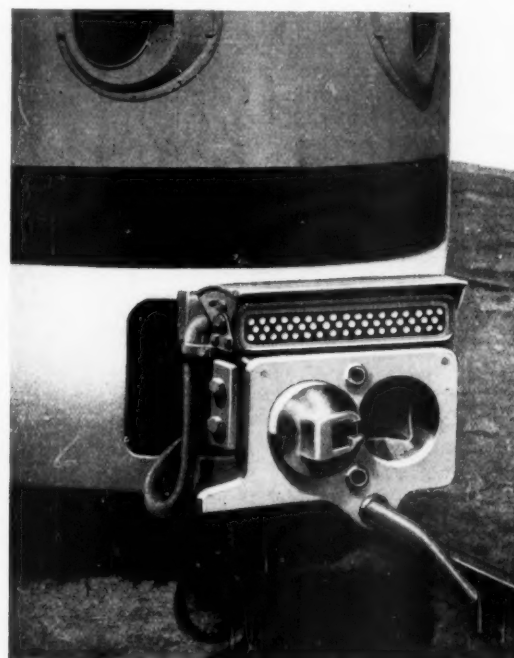


Diagram showing operation of Schaku coupler with disconnecting control from driving position

effected while the train is running, the incorporation of Schaku couplers renders possible the operation of slip coach services, and a further advantage is the reduction in the risk of telescoping in case of an accident, a feature which is shared by all automatic centre couplers.



Arrangement of connections required with the ordinary screw and link coupling



The Schaku automatic coupler with all necessary mechanical, air, steam, and electric connections

